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A SURVEY OF LITERATURE RELATED TO SELECTED NONPROFESSIONAL OCCUPATIONS.

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AS THE FIRST PHASE IN DEVELOPING A TESTING PROGRAM FOR VOCATIONAL PROGRAMS IN IDAHO, STUDIES CONCERNED WITH WORKER CHARACTERISTICS IN A VARIETY OF OCCUPATIONS WERE REVIEWED. THE PROFESSIONAL LITERATURE WAS SURVEYED FOR STUDIES RELATING TO SUCCESS AND/OR MEMBERSHIP IN 28 OCCUPATIONS FOR WHICH TRAINING PROGRAMS EXIST IN IDAHO SCHOOLS. THE PURPOSE WAS TO REVIEW STUDIES WHICH WOULD IDENTIFY TESTS FOR USE IN AN EXPERIMENTAL BATTERY. ALL BUT TWO STUDIES WERE PUBLISHED IN THE LAST 10 TO 15 YEARS. THE TYPES OF TESTS USED MOST FREQUENTLY WERE INTEREST, APTITUDE, AND PERSONALITY TESTS, AND THESE CATEGORIES ARE DISCUSSED. REVIEW OF SPECIFIC STUDIES AND TESTS REGARDING THE CHARACTERISTICS RELATED TO SUCCESS OR MEMBERSHIP IN 28 OCCUPATIONS ARE PRESENTED FOR AIRPLANE MECHANICS, AUTO BODY FENDERMEN, AUTO MECHANICS, AUTO SERVICE STATION SPECIALISTS, BEAUTY OPERATORS, BOOKKEEPERS, CABINETMAKERS, DENTAL ASSISTANTS, DIESEL MECHANICS, DRAFTSMEN, ELECTRICAL APPLIANCE REPAIRMEN, ELECTRONIC TECHNICIANS, FARM MACHINERY REPAIRMEN, FORESTRY TECHNICIANS, GENERAL OFFICE CLERKS, INSTRUMENT REPAIRMEN, MACHINISTS, OFFICE MACHINE REPAIRMEN, POLICEMEN, PRACTICAL NURSES, PRINTERS, RADIO-TV REPAIRMEN, SALES CLERKS, SALESPERSONS, SECRETARIES, STENOGRAPHERS, UPHOLSTERERS, AND WELDERS. (FS)

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A SURVEY OF LITERATURE RELATED TO SELECTED NONPROFESSIONAL OCCUPATIONS

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FOREWORD

This is an interim report, representing the first phase of a project concerned with the development of a testing program for vocational schools and/or programs in Idaho. Professional literature was surveyed for studies relating to success and/or membership in twenty-eight occupations for which training programs exist in Idaho schools, or which have been represented in adult education courses.

The main purpose of this phase of our study was to bring together the results of both specific and general studies which would serve to identify several types of tests which might be incorporated into an experimental battery. It was not our objective, at this point in the study, to provide vocational guidance personnel and vocational educators with a body of data complete and ready for use. While a person well grounded in testing and test theory might make some use of the data presented for individual occupations, extensive use of our findings for this purpose is not recommended. We believe that an effective counseling tool will result only after local validation studies have been completed in several Idaho schools.

We do not claim an exhaustive coverage of all recent research studies. It is likely that a few important articles and reports were missed in our survey. Furthermore, some recently published materials were not received in time to be incorporated in our report to the extent we would have wished. Examples of the latter are the Fourth Edition (1966) of the Manual for the Differential Aptitude Tests, which contains reports of studies with vocational school students. Also, advance literature was received on the new Kuder Occupational Interest Survey, but additional information on its development could not be obtained before our press deadline. We do not believe, however, that our general conclusions would be altered much, if any, by the inclusion of this and other additional material.

As of this writing, work is already underway on some exploratory validation studies in two Idaho area vocational schools. It may be some time, however, before an extensive body of test validity data is available. We hope eventually to provide validity data for tests and other related student characteristics, and to make provisions for a continual updating of this information. The ultimate objective is to place in the hands of vocational counselors and vocational educators a reference volume which will enable them to better assist students as they make their vocational choices, plans, and adjustments.

A SURVEY OF LITERATURE RELATED TO SELECTED NONPROFESSIONAL OCCUPATIONS

The vocational counselor, vocational educator, and others concerned with preparing students for occupations requiring less than a four-year college degree need reliable, up-to-date information regarding the characteristics which are related to success and/or membership in these occupations. This report contains what might be considered a logical "first step" toward the development of such a body of information for use in Idaho schools. Since practically no research has been completed in Idaho relating to the vocational education program, we decided to begin our research by reviewing the professional literature. We hope, in due time, to extend our research to specific studies in selected schools within the State of Idaho.

Anyone familiar with the professional literature realizes that thousands of studies have been completed which were concerned with worker characteristics in a wide variety of occupations. Indeed, a complete review of this material would have occupied all staff members of the State Occupational Research Unit for several months. But since reviews of this type already have been completed by others, our work was reduced to manageable proportions. We decided, therefore, to accept two reviews as representative of the work completed up to 1950 or slightly beyond, and to limit our survey to new studies published in the last 10 or 15 years. This approach also seems justified from another standpoint, namely, that studies more than 15 or 20 years old may not be relevant to present-day occupational requirements. Therefore, an extensive search of relatively old literature did not seem worth the time and effort required.

The two reviews referred to above are those by Dorcus and Jones (1950) and Ghiselli (1955). Dorcus and Jones conducted an extensive survey of validation studies in the vocational field, and published the result as abstracts in book form. The contents were indexed according to the type of employee studied. Studies dating as early as 1906 were included, thus covering nearly 50 years up to around 1950. Ghiselli searched the published literature from 1919 into the early 1950's, and also surveyed several unpublished investigations. Ghiselli arranged his results for several types of tests and for several occupational groups in the form of weighted averages through Fisher's z transformation.

We decided, in order to further reduce our study to manageable proportions, to survey the literature for studies relating to a limited number of occupations. The occupations are fairly representative of the training programs currently offered in Idaho high schools and area vocational schools. Furthermore, the

list includes occupations engaged in by both sexes, and a wide variety of work tasks is represented. The following list of occupations was selected for study:

Airplane Mechanic	Forestry Technician
Auto Body Fenderman	General Office Clerk
Auto Mechanic	Instrument Repairman
Auto Service Station Specialist	Machinist
Beauty Operator	Office Machine Repairman
Bookkeeper	Policeman
Cabinetmaker	Practical Nurse
Dental Assistant	Printer
Diesel Mechanic	Radio-TV Repairman
Draftsman	Sales Clerk
Electrical Appliance Repairman	Salesperson
Electronics Technician	Secretary
Farm Machinery Repairman	Stenographer
	Upholsterer
	Welder

TYPES OF TESTS AND RELATED INFORMATION

The tests which recurred most frequently in the literature surveyed can be classified in three broad categories, namely, interest, aptitude, and personality. Each type of test will be discussed separately under appropriate headings. This material is preparatory and preliminary to the contents of the next major section of this report, in which the specific results of our survey are presented for each of the 28 occupations included in our study.

Interest

The names Strong and Kuder have been associated with interest measurement for several years. Tests by these two authors apparently dominate the field. Indeed, the tests are common enough so that their names alone are a sufficient reference. Ghiselli (1955, p. 108) states, somewhat generally, that "Inventories of this kind . . . indicate preferences with regard to such topics as avocations, occupations, and school subjects."

Studies involving interest measures sometimes report correlation coefficients between interest scores and various criteria. More recently the tendency seems more toward identifying the existence of a scale--especially one empirically developed-- for a particular occupation. Therefore, in reporting our results, we will list various interest scales as important for an occupation, without any additional information such as correlations or

specific scores on the scale. In other cases we merely will state that a scale for the occupation has been developed on a particular test, the assumption being that the scale has been constructed to differentiate this occupational group from other workers.

Certain recent developments in interest measurement will be presented here which seem appropriate for the interpretation of later sections of this report. Silverman (1964) in a recent unpublished dissertation indicated that there are significant differences between vocational and academic student's interest patterns. In addition, significant differences were found among students enrolled in trade and technical curricula. Using the Hackman-Gaither Interest Inventory, Research Edition, Form M, Silverman was able to establish, through an analysis of variance, separate keys which were effective in differentiating female students in commercial, cosmetology, practical nursing, and professional nursing curricula, both from within the trade and technical samples and from students in an academic curriculum.

Silverman also constructed separate keys for males in agriculture, automotive, drafting and electronics curricula. These keys were also effective in differentiating students within the different trade curricula as well as effective in differentiating trade and technical students from academic students. Thus it does appear possible to differentiate students within different curricula. A possible next step would be to follow these students through into their actual work experience and see if there is any predictive value in this type of interest testing.

There is a new interest test now available for use with males who are considering entry into skilled trades occupations. The test is the Minnesota Vocational Interest Inventory, developed by Clark and Campbell (1965). The test, which has an item format much like the well known Kuder Vocational, has scoring scales for the following occupations:

Baker
Food Service Manager
Milk Wagon Driver
Retail Sales Clerk
Stock Clerk
Printer
Tabulating Machine Operator
Warehouseman
Hospital Attendant
Pressman
Radio-TV Repairman
Carpenter
Painter
Plasterer
Industrial Education Teacher
Truck Driver
Truck Mechanic
Sheet Metal Worker
Plumber
Machinist
Electrician

Homogeneous or area scales are available for the following:

Mechanical	Carpentry
Health Service	Sales-Office
Office Work	Clean Hands
Electronics	Outdoors
Food Service	

In this report, reference will be made only to the 21 occupational scales.

Aptitude

This is a classification which includes a wide array of tests. Since this type of test occurred frequently in the literature we surveyed, it seems appropriate to list here a fairly comprehensive set of definitions. Ghiselli (1955, pp. 105-107) listed and defined a number of different types of tests, which will be reproduced here in truncated form.

Tests of Intellectual Abilities

Intelligence. All tests that are ordinarily termed intelligence or mental alertness.

Immediate memory. In these tests, the subject is presented with some material, and, after a short period of time he is called upon to remember it.

Substitution. These tests require the subject to learn and utilize a code, such as A = 7, B = 2, etc.

Arithmetic. All tests that require arithmetic computations.

Tests of Spatial Perception

Spatial relations. Spatial judgments of various sorts are required. The most common kind requires the subject to determine the shape of the composite figure which will result when several plane figures are assembled.

Location. The subject must identify the location of each of a series of points and/or make judgments concerning the distances between them.

Tests of Perception of Details

Number comparison. The subject indicates which pairs of a series of paired numbers are the same and which are different.

Name comparison. The subject indicates which pairs of a series of paired names are the same and which are different.

Cancellation. Tests of this kind consist of letters or numbers arranged at random; the subject crosses out all letters or numbers of a specific kind.

Pursuit. These tests present tangles of lines; the task is to follow, by eye alone, one line at a time from beginning to end through the tangle.

Perceptual speed. The intent is to measure the speed with which similarities and differences in simple figures can be perceived.

Tests of Mechanical Comprehension

Mechanical principles. In these tests problems illustrative of simple mechanical principles are presented pictorially.

Tests of Motor Abilities

Tracing. Tests in this category are intended to measure speed and precision of movement.

Tapping. Emphasis is upon speed of movement; typically the subject taps as rapidly as be can with a pencil, putting two or three dots in each of a series of squares or circles.

Dotting. This test is similar to the tapping test, except that precision of movement is stressed.

Finger dexterity. All varieties of pegboard tests are grouped together in this category.

Hand dexterity. The major purpose is to sample a set of motions involving the wrist.

Arm dexterity. The purpose is to measure a very gross motor dexterity.

Reaction time. All tests of simple speed of reaction are included.

Complex reaction. A number of different types of rapidly changing stimuli are presented to the subject, who must respond differently to the various stimuli.

The purpose of Ghiselli's (1955) review was to obtain a representative value of the validity of each type of test for each type of job. The results are in terms of average validity coefficients. It was found necessary to divide criteria of occupational success into two broad classes:

> Though occupational success has been gauged in numerous ways, it is possible to differentiate two major types of criteria: those which relate to the capacity of novices to acquire job skill and knowledge, and those which relate to the level of proficiency on the job attained by workers already trained. Examples of training are grades in occupational courses, the passing or failing of such courses, and instructor's ratings of learners. Examples of proficiency criteria are production, supervisor's ratings of job proficiency, sales, and, in certain studies of vehicle operators, accidents. (Ghiselli, 1955, p. 108)

For the purposes of this general review, only those specific tests with average validity coefficients presented by Ghiselli which are .30 or above are named. In a few instances where 1,000 or more cases made up a sample, tests with correlations below .30--but never below .20--are included.

Since the General Aptitude Test Battery (GATB) is the primary source of information in this report, the following nine aptitudes measured by the GATB, B-1002 Edition, will be defined. The definitions are quoted from the test manual (U.S. Department of Labor, 1962b, pp. 14-15), except for a few minor omissions:

General learning ability. The ability to "catch on" or understand instructions and underlying principles; the ability to reason and make judgments. Closely related to doing well in school.

Verbal aptitude. The ability to understand meaning of words and to use them effectively. The ability to comprehend language, to understand relationships between words and to understand meanings of whole sentences and paragraphs.

Numerical aptitude. Ability to perform arithmetic operations quickly and accurately.

Spatial aptitude. Ability to think visually of geometric forms and to comprehend the two-dimensional representation of three-dimensional objects. The ability to recognize the relationships resulting from the movement of objects in space.

Form perception. Ability to perceive pertinent detail in objects or in pictorial or graphic material. Ability to make visual comparisons and discriminations and see slight differences in shapes and shadings of figures and widths and lengths of lines.

Clerical perception. Ability to perceive pertinent detail in verbal or tabular material. Ability to observe differences in copy, to proofread words and numbers, and to avoid perceptual errors in arithmetic computation.

Motor coordination. Ability to coordinate eyes and hands or fingers rapidly and accurately in making precise movements with speed. Ability to make a movement response accurately and swiftly.

Finger dexterity. Ability to move the fingers, and manipulate small objects with the fingers, rapidly and accurately.

Manual dexterity. Ability to move the hands easily and skillfully. Ability to work with the hands in placing and turning motions.

The development of norms for specific occupations using the GATB is a fairly lengthy process, and is described in the test manual (U.S. Department of Labor, 1962b, pp. 39-47). Briefly, the entire test battery is administered to a group of students in training or to a group of employed workers. The test results

are related to some suitable criterion measure, and a multiple cut-off profile of at least two and as many as four scores is constructed from the nine factor scores. Correlation coefficients--tetrachoric correlations and more recently phi coefficients--then are computed from a four-cell table. The latter is formed by a dichotomy of passage and failure on the multiple cut-off profile on one axis, and a division into "good" workers and "poor" workers on the other axis. Later in this report, GATB validation studies are reported in terms of the factors included in the multiple cut-off profile and the resulting correlation coefficient.

The Flanagan Aptitude Classification Tests (1959)--abbreviated FACT--are also referred to quite frequently in this report. The definitions of the subtests are paraphrased below, as taken from the Student's Booklet of the FACT:

Inspection. Ability to spot flaws or imperfections in a series of articles quickly and accurately. The test was designed to measure the type of ability required in inspecting finished or semifinished manufactured items.

Coding. Speed and accuracy of coding typical office information. A high score can be obtained either by learning the codes quickly or by speed in performing a simple clerical task.

Memory. Success in learning and remembering the codes given in the Coding test. This test provides a sample of the ability to memorize printed materials.

Precision. Speed and accuracy in making very small circular finger movements with one hand and with both hands working together. This test samples the ability to do precision work with small objects.

Assembly. Ability to "see" how an object would look when put together according to instructions, without having an actual model to work with. This test samples the ability to visualize the appearance of an object assembled from a number of separate parts.

Scales. Speed and accuracy in reading scales, graphs, and charts. This test samples scale-reading of the type required in engineering and similar technical occupations.

Coordination. Ability to coordinate hand and arm movements. It involves the ability to control movements in a smooth and accurate manner when these movements must be continually guided and readjusted in accordance with observations of their results.

Judgment and comprehension. Ability to read with understanding, to reason logically, and to use good judgment in practical situations.

Arithmetic. Skill in working with numbers--adding, subtracting, multiplying, and dividing.

Patterns. Ability to reproduce simple pattern outlines in a precise and accurate way. Part of the test requires the

ability to sketch a pattern as it would look if it were turned upside down.

Components. Ability to identify important component parts. The samples used are line drawings and blueprint sketches. It is believed this performance should be representative of the ability to identify components in other types of complex situations.

Tables. Performance in reading two types of tables. The first consists entirely of numbers; the second contains only words and letters of the alphabet.

Mechanics. Understanding of mechanical principles and the ability to analyze mechanical movements.

Expression. Feeling for and knowledge of correct English. This test samples certain communication tasks involved in getting ideas across in writing and talking.

Reasoning. Tests the ability to translate ideas and operations into brief mathematical concepts and notations.

Vocabulary. Tests for meanings of words in various fields.

Planning. Ability to plan, organize, and schedule in regard to problems which may arise.

Ingenuity. Tests for ability to create or invent; to devise ingenious procedures, equipment, or presentations.

Alertness. Designed to measure alertness in hazardous or dangerous situations.

Personality

Ghiselli (1955, pp. 107-108) includes a wide variety of personality inventories under this heading; apparently the classification was so broad that he decided not to state any precise definition. He gives the Bernreuter Personality Inventory as typical, and the sophisticated reader should not have difficulty in generalizing to other instruments which logically should be classified here. Ghiselli also includes tests of interest, which we have dealt with separately, and personal data blanks. The latter usually contain a wide variety of questions on the characteristics of the individual and his background, such as age, sex, marital status, education, occupation, etc.

Thus having given a general orientation to our study, and definitions of several types of tests, we proceed to the next major section in which specific studies relating to the 28 occupations listed on page 2 will be presented. The final section of the report represents an attempt to draw together our findings, and, relating them to other general studies, to arrive at a tentative list of several types of tests which might be included in a test battery for vocational school selection and placement.

LITERATURE SURVEY FOR INDIVIDUAL OCCUPATIONS

Airplane Mechanic — Old DOT code: 5-80.100
New DOT code: 621.281

Ghiselli (1955) reports that intelligence, immediate memory, arithmetic, spatial relations, perceptual speed, and mechanical principles are important in success in training for airplane mechanics. He also reports that arithmetic, number comparison, name comparison, and pursuit correlate highest with actual job success.

GATB Technical Report B-370, November, 1957 based on a sample of 75 students in a Detroit Vocational High School reported a tetrachoric correlation coefficient of .57 between General Learning Ability, Form Perception, Numerical Aptitude, and the criterion of course grades.

A study of 10th grade students in aviation mechanics in a New York trade school using the Flanagan Aptitude Classification Tests (1959) indicated that their better scores (they were compared only to themselves) were on Mechanics, Patterns, Alertness, Assembly, Inspection, and Scales.

Auto Body Fenderman — Old DOT code: metal, 5-81.510
New DOT code: 807.381

The GATB Technical Report B-593, September, 1964, gives a phi coefficient of .545 between Spatial Aptitude, Form Perception, Manual Dexterity, and the criterion of supervisor's ratings, based on a sample of 56 Minneapolis Area Vocational School students. These norms are not included in the current Occupational Aptitude Pattern (OAP) structure.

Samuelson (1956) reported a multiple correlation coefficient of .508 between a three part instructor's rating and Finger Dexterity and Clerical Perception on the GATB for a group of 28 male students enrolled in a Salt Lake Area Vocational School.

A high mechanical interest on the Kuder Vocational (1960) is assumed to be important in training and job success, although there is little available research to validate this statement.

Auto Mechanic — Old DOT code: 5-81.010
New DOT code: 620.281

The use of the Differential Aptitude Tests for overall prediction in 12th grade vocational high school success was not satisfactory according to a study of Doppelt, et al. (1959).

Testing of 10th grade vocational students with the Flanagan Aptitude Classification Tests (FACT) indicated that, in general, their scores were low, with their higher scores being on Inspection, Alertness, and Mechanics. No information on eventual job or training success was given in that report (FACT, 1959).

GATB Technical Report B-276, August, 1953, based on a sample of 50 male auto mechanic trainees in Brooklyn, New York, resulted in a tetrachoric correlation of .61 between General Learning Ability, Spatial Aptitude, Finger Dexterity, and the criterion of grades received in the course.

Samuelson (1956) reported a multiple correlation coefficient of .531 between a three part instructor's rating and General Learning Ability, Finger Dexterity, and Manual Dexterity on the GATB for a group of 36 male students enrolled in a Salt Lake Area Vocational School.

Ghiselli (1955) indicates that intelligence, arithmetic, perceptual speed, mechanical principles, and spatial relations tests correlate significantly with training as an auto mechanic.

The Kuder Preference Manual (1960) lists Mechanical-Scientific, or Mechanical Clerical interests as being possible interest patterns for an auto mechanic. However, there is no actual research to validate this assumption. Keys for auto mechanic were developed by Silverman (1964) and by Clark and Campbell (1965), using the Hackman-Gaither Interest Inventory and the Minnesota Vocational Interest Inventory, respectively. It should be pointed out that the scale on the Minnesota test is for Truck Mechanic, which may differ slightly from auto mechanic.

Auto Service Station Attendant — Old DOT code: 7-60.500; New DOT code: 915.867

GATB Technical Report B-469, September, 1962, based on a sample of 52 male employees at eleven service stations in Philadelphia, Pennsylvania, indicated a tetrachoric correlation of .72 between Numerical Aptitude, Finger Dexterity, Manual Dexterity, and the criterion of supervisory ratings. No other information for this occupation was found in the literature.

Beauty Operator — Old DOT code: 2-32.15; New DOT code: 332.271

The GATB Technical Report B-316, October, 1955, used a sample of 65 female students in cosmetology in eight beauty schools in five cities in Idaho. The criterion consisted of instructor's rank order ratings. The tetrachoric correlation for this study was .59 between General Learning Ability, Verbal Aptitude, Form

Perception, Finger Dexterity, and the criterion ratings.

A cross validation study based on 34 students in Austin, Minnesota, using two criteria of course grades and instructor's ratings, resulted in the same test norms on the GATB as in the Idaho study, and a correlation of .63 was reported. The combined sample yielded a tetrachoric correlation of .59, indicating a significant relationship.

Silverman (1964) was able to differentiate female students in cosmetology, using the Hackman-Gaither Interest Inventory.

Bookkeeper II — Old DOT code: 1-01.02
New DOT code: 210.388

Thorndike and Hagen (1959, p. 240) describe 143 male workers in accounting record work, such as bookkeepers or bank tellers, who were tested by an Air Force aptitude battery in 1943 and followed up in 1955 and 1956, as having high numerical ability with lower general intelligence and very low mechanical aptitude. Thorndike also indicates that these people were rather non-academic, non-athletic, non-mechanical, and non-social as compared with the total population of respondents. Attempts to correlate specific characteristics with criteria of job success were not successful.

The FACT manual (1959) suggests that higher scores on Inspection, Tables, Arithmetic, Precision and Coding are important to job success. A five year follow-up of 55 bookkeepers resulted in a correlation coefficient between the above five subtests on the FACT and the criterion of .02. This is not significant. The authors state that the factors related to motivation, personality, opportunity, and special assistance from family appear more important than aptitudes of the type measured. (FACT, 1959, p. 26)

Ghiselli (1955) indicates that intelligence, substitution, arithmetic, and number comparison tests are useful predictors of success in training as bookkeeping machine operators. Number comparison, name comparison, and arm dexterity seem to correlate with job performance.

Dorcus and Jones (1950, Abstract No. 400, p. 318) report a study of 72 bookkeepers tested in 1948 with a battery of tests including: Lee-Clark Arithmetic Fundamentals Survey Test; 1947 California Short-Form Test of Mental Maturity, Number Series; a verbal checking test; Ruch Survey of Working Speed and Accuracy, Number Checking and Counting Vowels; and the MacQuarrie Test for Mechanical Ability, Blocks, Location, and Tracing. The validity correlation between the test battery and the criterion of ratings by instructors was .89. Additional entries in Dorcus and Jones

(Abstracts No. 311, 277, 141 and 39) indicate that intellectual ability is an important quality found in successful bookkeepers.

GATB Technical Report B-454, October, 1961, based on a sample of 66 bookkeeping students in business colleges in Florida revealed a tetrachoric correlation coefficient of .73 between General Learning Ability, Verbal Aptitude, Numerical Aptitude, and the criterion of instructor's ratings. These norms did not meet the requirements to be included in the 1962 OAP structure. The GATB manual (U.S. Department of Labor, 1962b, Table 34) reports a study of 66 bookkeeping students (mostly males). General Learning Ability, Verbal Aptitude, and Numerical Aptitude correlated .68 (tetrachoric r) with instructor's ratings. Also, 60 female bookkeeping machine operators were rated on a criterion of production records. Numerical Aptitude, Form Perception, Clerical Perception, and Finger Dexterity yielded a tetrachoric correlation of .65.

Silverman (1964) was able to differentiate female students in the commercial curriculum using the Hackman-Gaither Interest Inventory. Strong (1951) developed a scale on the men's Strong Blank for Office Worker.

Cabinet Maker I — Old DOT code: 4-32.100
New DOT code: 660.280

Thorndike and Hagen (1959, p. 264) describe 27 male cabinet makers or wood workers who were tested by an Air Force aptitude battery in 1943 and followed up in 1955 and 1956, as having high mechanical and lower numerical and general intelligence. They also had a history of manual and mechanical activities as well as low educational achievement. Attempts to correlate specific characteristics with criteria of job success were not successful, although these men had been working as cabinet makers or wood workers for an average of 7½ years.

GATB Technical Report B-355, August, 1964, based on a sample of 81 Minnesota vocational students, revealed a phi coefficient of .422 between General Learning Ability, Numerical Aptitude, Spatial Aptitude, and Manual Dexterity and the criterion of instructor's ratings. A cross validation study was run on a sample of 31 male workers in Nebraska, and a phi coefficient of .402 was found between the above test norms and supervisory ratings.

Dorcus and Jones (1950, Abstract No. 87) report a study of 36 cabinet makers tested in 1926 with a series of tests which were miniature job situations. These tests, such as: ability to judge straightness of a board, ability to judge right angles, ability to judge length of stroke with a plane, and space

perception, all correlated between .72 and .87 with the criterion of supervisory classifications.

Ghiselli (1955) indicates that spatial relations and location are useful predictors for success in training in skilled general woodworking.

Dental Assistant — Old DOT code: 1-31.10
New DOT code: 079.378

GATB Technical Report B-475, February, 1964, based on an original validation sample of 53 female students in a Washington technical school, reported a phi coefficient of .53 between General Learning Ability, Spatial Aptitude, Clerical Perception, Finger Dexterity, and the criterion of supervisory ratings. A cross validation study with 85 California students resulted in a phi coefficient of .21 between the above norms and supervisory ratings. These norms are not, however, included in the 1962 OAP structure because they did not meet certain statistical requirements.

Diesel Mechanic — Old DOT code: 5-81.650
New DOT code: 625.281

Ghiselli (1955) reports that intelligence, arithmetic, spatial relations, perceptual speed, and mechanical principles are important for success in training as a skilled motor mechanic.

Thorndike and Hagen (1959), in their description of 98 engine mechanics tested by an Air Force aptitude battery in 1943 and followed up in 1955 and 1956, state that these men were above average on a mechanical ability composite score. They also had a low academic background, low verbal ability, and enjoyed interpersonal relationships to a less extent than did most of the other occupations described. The most prevalent characteristic was a background of mechanical experience. These men had spent an average of 7 years in this occupation.

A five-year study using the FACT (1959) occupational profile for mechanics revealed a validity coefficient of .30 between Mechanics, Assembly, Components, Scales, Coordination, Patterns, and the criterion of progress and performance. The problem here is that the sample of 96 persons used in this study included electricians, machinists, and plumbers, in addition to mechanics, so that the results are not specific to one occupation.

Samuelson (1956) studied 13 diesel mechanics in training at the Salt Lake Area Vocational School. He found a multiple correlation coefficient of .635 between GATB subtests of General Learning Ability, Finger Dexterity, Clerical Perception, and a

three part instructor's rating. The number in the sample was too small, however, for a significant level of confidence for this correlation.

Draftsman

Architectural:	Old DOT code:	0-48.05
	New DOT code:	001.281
Mechanical:	Old DOT code:	0-48.18
	New DOT code:	007.291
Structural:	Old DOT code:	0-48.25
	New DOT code:	005.281

Ruch and Ruch (1960) used the Employee Aptitude Survey in a study of drafting trainees taking two two-month training sessions in a large aircraft manufacturing plant. The study showed significant correlations between Numerical Ability, Visual Speed and Accuracy, Space Visualization, Numerical Reasoning, Verbal Reasoning, and instructor ratings.

The FACT (1959) occupational profile recommended for draftsmen is high scores (median = 62) on Mechanics, Assembly, Judgment and Comprehension, Components, Scales, Coordination, and Patterns. A sample of 15 high school seniors took an early experimental edition of the FACT battery in the spring of 1947 and were later followed up on the job at various Pittsburg area industries in which the sample had been employed as draftsmen. A significant correlation of .60 was found between the Assembly subtest and the criterion of rate of salary increase on the job.

Thorndike and Hagen (1959) in their description of draftsmen found these men to be high in perceptual-spatial tests; poor on number tests; low on a wide variety of verbal, aesthetic, athletic, and social items on the personal data sheet. Draftsmen had an interest in things done with their hands.

Dorcus and Jones (1950, Abstract No. 380) report a correlation of .54 between the performance of 150 engineering draftsmen on the Case-Ruch Survey of Spatial Relations Ability and the criterion of supervisory ratings. Abstract No. 323 summarizes a study in which 165 draftsman trainees were given the Minnesota Paper Formboard and the MacQuarrie Test of Mechanical Ability. Correlations of .48 and .41 respectively were found between the test performance of the group and their grades at the end of the training class.

GATB Technical Report B-543, June, 1963, reports a validation study based on 52 workers in the Pennsylvania area. The phi coefficient was .30 between General Learning Ability, Numerical Aptitude, Spatial Aptitude, and the criterion of supervisory

ratings. The cross validation study based on 93 drafting students in Michigan and Washington resulted in a phi coefficient of .23 between the above norms and instructor's ratings. However, these norms did not meet the requirements to be included in the 1962 OAP structure. The test manual (U.S. Department of Labor, 1962b, Table 34) reports validation studies with Architectural Draftsmen (N = 40; tetrachoric r = .57), Mechanical Draftsmen (N = 53; tetrachoric r = .64), and Structural Draftsmen (N = 93; tetrachoric r = .59). The criterion was instructor's ratings and school grades, and the factors selected were General Learning Ability, Spatial Aptitude, Form Perception, and Finger Dexterity.

Silverman (1964) was able to develop a key for male students in the drafting curriculum

Electrical Appliance Serviceman — Old DOT code: 5-83.041; New DOT code; 827.281

GATB Technical Report B-450, August, 1961, based on a sample of 53 employees in California, resulted in a tetrachoric correlation of .53 between General Learning Ability, Numerical Aptitude, Spatial Aptitude, and the criterion of supervisory ratings.

Electonics Technician

Professional and kindred: Old DOT code: 0-67.110; New DOT code: 003.181

Any industry: Old DOT code: 5-83.444; New DOT code: 828.281

GATB Technical Report B-573, March, 1964 (professional and kindred), based on a sample of 97 students at the Milwaukee Institute of Technology, resulted in a phi coefficient of .515 between General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, and the criterion of grade point average in the course. A cross-validation sample of 51 male Ohio electronics technician students resulted in a phi coefficient of .36 between the above norms and course grade point averages.

GATB Technical Report B-359, May, 1957 (any industry), based on a sample of 50 men employed as Electronics Technicians in an aircraft corporation in California resulted in a tetrachoric correlation of .68 between General Learning Ability, Spatial Aptitude, Form Perception, and supervisory ratings.

The FACT (1959) occupational profile suggests Mechanics, Assembly, Judgment and Comprehension, Precision, and Alertness as subtests on which a person considering electronics should

score high. A sample of 33 Pittsburg high school seniors took an experimental edition of the FACT battery in the spring of 1947. They were followed up in 1950 and 1951, and were compared against the criterion of rate of salary increase. The test-criterion correlations were Judgment and Comprehension, .60; Precision, .51;--both significant at the 1% level.

Dorcus and Jones (1950, Abstract No. 171) report a correlation of .67 between the performance of 27 electrical troublemen on the MacQuarrie Test for Mechanical Ability; Pursuit and Blocks; an arithmetic test; an electrical circuit test; and an electrical information test; and the criterion of ranking by supervisors.

The FACT battery was administered to two New York electrical trade schools, with a sample of 164 to 167 students per test. The two tests on which the students scored highest were Alertness and Coordination, with percentiles of 50 and 48, respectively.

Ghiselli (1955) suggests general intellectual ability and perceptual speed are important characteristics in training as well as job performance.

Samuelson (1956) studied a sample of 23 electronics students at the Salt Lake Area Vocational School, and found a multiple correlation of .69 between GATB subtests of Finger Dexterity, Spatial Aptitude, Manual Dexterity, and a three part instructor's rating used as the criterion.

Silverman (1964) constructed an interest key for the electronics curriculum, using the Hackman-Gaither Interest Inventory.

Farm Equipment Mechanic — Old DOT code: 5-83.934; New DOT code: 624.281

GATB Technical Report B-611, January, 1965, based on a sample of 50 male employees in the state of Nebraska, indicated a *phi* coefficient of .29 between General Learning Ability, Spatial Aptitude, Finger Dexterity, and the criterion of supervisory ratings. However, these norms did not meet the minimum criterion for inclusion in the 1962 OAP structure.

Silverman (1964) was able to differentiate students in the agriculture curriculum, using the Hackman-Gaither Interest Inventory. Perhaps this would include farm mechanics, although workers in this job may have interests which resemble more the interest pattern of workers in, say, automotive mechanics.

Forestry Technician — Old DOT code: 0-35.07; New DOT code: 040.081

GATB Technical Report B-520, April, 1963, based on a sample of 80 U.S. Forest Service employees in California and Wyoming, indicated a phi coefficient of .26 between the test norms of Verbal Aptitude, Spatial Aptitude, Motor Coordination and the criterion of supervisory ratings. However, these norms did not meet the minimum requirements for inclusion in the 1962 OAP structure.

General Office Clerk — Old DOT code: 1-05.01; New DOT code: 219.388

The performance of 55 male employees on the Differential Aptitude Tests (Bennett, et al., 1959) show average percentile scores on Spelling, Sentences, and Abstract Reasoning. This group also showed a little below average scores (i.e. 41-45 percentile) on the rest of the DAT profile.

A group of 265 female general office clerks showed somewhat inferior scores compared to the average high school graduate. There were no special strengths or weaknesses with which they could be identified. (Bennett, et al., 1959, p. 62)

Roe (1956), in summarizing several different studies, states that correlations between clerical tests and intelligence may range between about .35 and .65. However, for adequate performance of average clerical work, an IQ of at least 90 is needed. In addition, Roe summarizes a study with a personality inventory involving 192 clerical workers. The study indicated that an average clerical worker is not moody or subject to worry, is even-tempered, unwilling to accept responsibility, non-social, lacks self-sufficiency, and does not crave admiration.

Ghiselli (1955) indicates that intelligence, arithmetic, number and name comparison are valuable characteristics in training as a general office clerk. Intelligence, immediate memory, substitution, arithmetic, personality and personal data are valuable predictors of success in actual job performance.

Dorcus and Jones (Abstract No. 409, 1950) summarized a study of 314 general clerical workers in which the following correlation was found between tests and supervisor's ratings: Immediate Memory, .36; Arithmetic, .20; Substitution, .32; Number Comparison, .31; and Name Comparison, .27.

GATB Technical Report B-609, January, 1965 presents two studies dealing with general office clerks. The first study used 198 clerks in Ohio, and reported a phi coefficient of .193

between General Learning Ability, Verbal Aptitude, Clerical Perception, and the criterion of supervisory ratings. The second study, used as a cross-validation, was based on 103 clerks in Pennsylvania. The phi coefficient here was .30 between the above norms and the criterion.

FACT (1959) subtests which are said to be important in this occupation are Tables, Arithmetic, Coding, and Memory. A sample of 275 high school seniors took an early experimental edition of the FACT battery in the spring of 1947, and were followed up in 1950 and 1951. Correlations of .44, .25, and .23 were found between Table and Scale Reading (combined), Arithmetic, and Memory, respectively, and the criterion of rate of salary increase.

Silverman (1964) developed an interest key for female students in the commercial curriculum, using the Hackman-Gaither Interest Inventory. There also is a scale on the women's Strong Blank (Strong, 1951) for Office Worker.

Instrument Repairman — Old DOT code: 5-83.425; New DOT code: 710.281

GATB Technical Report B-598, October, 1964, based on 65 male students in a Texas junior college training course, indicated a phi coefficient of .258 between General Learning Ability, Numerical Aptitude, Spatial Aptitude, Manual Dexterity, and the criterion of the final grade for the course.

Machinist — Old DOT code: 4-75.010; New DOT code: 600.280

Ghiselli (1955) found intelligence, arithmetic, perceptual speed, and mechanical perception to be related to success in training as a machinist. Pursuit is related to actual job performance.

Thorndike and Hagen (1959), in their description of machinists tested by the Air Force battery in 1943 and followed up in 1955 and 1956, state that these men were high in mechanical and psychomotor skills and below average in general intelligence, when compared to the rest of the tested population. These men also had past experience and interest in mechanical activities. In addition, they showed low participation in verbal, aesthetic and interpersonal activities.

Dorcus and Jones (1950, Abstracts No. 378, 306, and 298) report several studies in which tests such as the Bennett Mechanical Comprehension and the Purdue Mechanical Assembly were valuable in predicting job success for various types of machinists and machine tool operators. Various tests of visual-motor

ability were also valuable screening instruments.

The FACT (1959) subtests on which a prospective student should obtain higher scores (median of 40) are: Mechanics, Assembly, Components, Arithmetic, Scales, and Alertness.

Doppelt, et. al. (1959) found that the sum of the scores of Mechanical Reasoning, Space Relations, and Abstract Reasoning on the Differential Aptitude Tests were useful in predicting success in trade school machine shop courses at the 11th and 12th grade level.

GATB Technical Report S-12, September, 1952, based on a sample of 71 employed machinists in Michigan, indicated a tetrachoric correlation of .43 between General Learning Ability, Numerical Aptitude, Spatial Aptitude, Manual Dexterity, and the criterion of supervisory ratings. The cross-validation sample consisted of 40 machinist students in Washington. The tetrachoric correlation here was .75 between the above test norms and instructor's ratings. The combined sample of 111 results in a tetrachoric correlation of .56 between the test norms and the criterion.

The new Minnesota Vocational Interest Inventory (Clark & Campbell, 1965) has a scale for Machinist.

Office Machine Repairman — Old DOT code: 5-83.111; New DOT code: 633.281

Thorndike and Hagen (1959) described these men as having high general intelligence, above average psychomotor, mechanical, and perceptual-spatial ability.

Typewriter serviceman trainees (N = 130), tested with the FACT (1959) while in a company training course in 1958, were tested at the end of the course with an objective achievement test which served as the criterion. Correlations of .29 and .19 were found between Assembly and Mechanics, respectively, and the criterion.

GATB Technical Report B-511, April, 1963, based on a sample of 62 trainees in Ohio, resulted in a phi coefficient of .50 between Spatial Aptitude, Form Perception, Motor Coordination, Manual Dexterity, and the criterion of supervisory ratings. A cross-validation study using 55 employees in California resulted in a phi coefficient of .40 between the above norms and the criterion.

Policeman Old DOT code: 2-66.23
New DOT code: 375.268

Thorndike and Hagen (1959), in their description of 119 men who were tested in 1943 with the Air Force battery and followed up in 1955 and 1956, state that these men scored average on the psychomotor tests, scored low on general intelligence, had poor quantitative scores, and had a limited academic background. They had done well in physical activities and sports.

Ghiselli (1955) reported that intelligence, spatial relations, perceptual speed, and mechanical principles are important in predicting success in training. Intelligence, immediate memory, and mechanical principles are important in proficiency on the job.

The recommended tests on the FACT (1959) on which the student should score higher (median of 40) are: Judgment and Comprehension, Components, Alertness, and Memory.

Matarazzo, et al. (1964) undertook a study of police applicants over a period of several years in the Portland, Oregon, area. Using instruments such as the Wechsler Adult Intelligence Scale, Minnesota Multiphasic Personality Inventory, and Edwards Personal Preference Schedule, they arrived at some general personality characteristics of successful policemen. The average Full Scale IQ for this group was 112. Personality needs suggested are: to excell or achieve, to be the center of attention, to understand and dominate others, to stick to a job until done, to be "one of the boys" among men, to like to work with other people, need little kindness from others, give little sympathy to others, and to feel little animosity and aggression toward their fellow men. Policemen were suggested to be oriented toward working with people, and to be rugged, outdoor, family handymen. Additional personality characteristics as a result of MMPI testing are: blustery, sociable, exhibitionistic, active, opportunistic, and impulsive. They also attempt to manipulate others to gain their own ends, are unable to delay gratifications, and have some tendency toward overindulgence in sex and drink.

GATB Technical Report B-513, April, 1963, based on a sample of 166 California city policemen, indicated a phi coefficient of .22 between General Learning Ability, Form Perception, Clerical Perception, and the criterion of supervisory ratings. A cross-validation sample of 166 Wisconsin policemen resulted in a phi coefficient of .30 between the above test norms and supervisory ratings. These norms are not included in the 1962 OAP structure, as they did not meet certain minimum statistical criteria.

Several entries in Dorcus and Jones (1950, Abstracts No. 213a and 116), although very old (1926 and 1936) suggest that

intelligence related to success on the job as a policeman.

An interest key for policeman may be found on the Strong Blank for men (Strong, 1951).

Practical Nurse (general duty) Old DOT code: 0-33.10
New DOT code: 075.378

Nurse, Practical Old DOT code: 2-38.20
New DOT code: 079.378

GATB Technical Report B-548, June, 1963, based on a sample of 50 females employed in Arizona, resulted in a phi coefficient of .276 between Verbal Aptitude, Clerical Perception, Manual Dexterity, and the criterion of supervisory ratings. These norms are not included in the 1962 OAP structure because they did not meet minimum statistical requirements. The test manual (U.S. Department of Labor, 1962b, Table 34) reports a combined sample of Nurse, General Duty of 244 students. General Learning Ability, Numerical Aptitude, and Clerical Perception yielded a tetrachoric correlation of .53. Also, a combined sample of both trainees and students, numbering 194, were tested in a Nurse, Practical program. General Learning Ability, and Manual Dexterity, related to instructor's ratings, yielded a tetrachoric correlation of .51.

Garrett (1960) found that high school grade point average, arithmetic, silent reading, and clerical aptitude were effective predictors of success in training.

In a seven-year follow-up study reported in the manual of the Differential Aptitude Tests (1959), a group of 28 women who later became nurses were tested with the DAT in 1947 and followed up in 1955. They had a high over-all profile with percentiles ranging from 58 to 78. The highest scores were in Verbal Reasoning, Numerical Ability, Space Relations, and Arithmetic Reasoning.

The recommended FACT (1959) profile for nursing is higher scores (median of 40) on Tables, Judgment and Comprehension, Expression, Alertness, and Memory. A sample of 32 high school seniors took an experimental edition of the FACT battery in the spring of 1947. These students who were working as nurses in the Pittsburg area were followed up in the winter of 1950 and 1951, and their FACT scores compared to the criterion of rate of salary increase. Significant correlations of .49 and .47 were found between Memory, and Judgment and Comprehension, respectively.

Roe (1956) reports a study by Triggs (p. 222) in which 826 nurses were tested with the Kuder Preference Record and compared with a normative group of 1,429 women-in-general. The nurses

differed significantly from the norms in the following ways: Higher on: Social Service, Scientific, Artistic and Musical. Lower on: Persuasive, Clerical Computational, and Literary. Roe reports also that success in training can usually be predicted with a scholastic test.

Silverman (1964) was able to differentiate students in the practical nursing curriculum, using the Hackman-Gaither Interest Inventory. The Minnesota Vocational Interest Inventory (Clark & Campbell, 1965) has a key for male Hospital Attendants. The women's Strong Blank (Strong, 1951) has a key for Nurse.

Printer

Compositor: Old DOT code: 4-44.010
New DOT code: 973.381

Linotype Operator: Old DOT code: 4-44.110
New DOT code: 650.582

Ghiselli (1955) lists intelligence, number and name comparison, pursuit, and location as useful in predicting success in training as skilled compositors and typesetters. No information was given for prediction of job performance.

The suggested FACT (1959) subtests on which prospective students should score high (median of 44) are: Inspection, Mechanics, Scales, and Precision. The FACT was given to about 260 students during their first semester of the tenth grade in a selected printing vocational school in New York City. The students achieved near the national mean (percentiles are based on national tenth-grade norms) on the Inspection, Mechanics, Tables, Arithmetic, and Alertness subtests. The printing group tended to be low on Reasoning, Judgment and Comprehension, Planning, Ingenuity, Scales, Expression, Precision, Coordination, and Coding tests. However, this only describes how a selected group of vocational high school students performed. No predictive emphasis should be placed on these findings at this time.

Thorndike and Hagen (1959) found that printing craftsmen had below average test profiles including both intelligence and mechanical ability. These men also had limited general experience in the trades. Printing pressmen had high mechanical and psychomotor abilities, but low general intelligence.

A sample of 164 linotype operator vocational students was given the GATB in 1956. The study resulted in a tetrachoric correlation of .65 between Form Perception, Clerical Perception, Motor Coordination, and the criterion of supervisory ratings (U.S. Department of Labor, 1962b, Table 34).

The Minnesota Vocational Interest Inventory (Clark & Campbell, 1965) has keys for Printer and Pressman. The men's Strong Blank (Strong, 1951) has a key for Printer.

Radio-TV Repairman

Radio Repairman I: Old DOT code: 5-83.411
New DOT code: 720.281

Television Service and Repairman: Old DOT code: 5-83.416
New DOT code: 720.281

Ghiselli (1955) reports intelligence, substitution, arithmetic, spatial relations, and location as important for criteria of success in training in the electrical repairing crafts. Intelligence and spatial relations relate significantly to proficiency criteria.

The GATB test manual (U.S. Department of Labor, 1962b, Table 34) gives results for a combined sample of 127 male students in radio-tv repair. A tetrachoric correlation of .61 was obtained between Numerical Aptitude, Spatial Aptitude, and Finger Dexterity and course grades.

The Minnesota Vocational Interest Inventory (Clark & Campbell, 1965) has a key for Radio-TV Repairman.

Sales Clerk (retail trade) Old DOT code: 1-70.10
New DOT code: 290.478

Roe (1956, p. 192) reports a study in which five hundred sales clerks in a large New York department store were tested with a group intelligence test. Seventy-five percent of these persons had IQ's between 80 and 110, with 20 per cent below this and 5 per cent above. These figures are very close to expectancy, so that all we know is that these sales clerks are average in intelligence. The study further demonstrated no significant relation between intelligence and success at selling. Another study reported by Roe indicated that sales clerks scored high in social dominance on the Bernreuter Personality Inventory. The same study also reported that better salespeople are: less moody, more self-sufficient, and more self-confident, more aggressive, more social, less self-conscious, less desirous of telling of their own good or bad fortune, less resentful of criticism, and more radical and unconventional.

The FACT (1959) profile for this occupation is Arithmetic, Scales, and Alertness. However, the median for these subtests is very low--a percentile of twenty-five.

Ghiselli (1955) indicates that personality and interest factors are important predictors of success in training as a sales clerk. Ghiselli and Barthol (1953) reported a mean validity coefficient of .36 for sales clerks, based on 1,120 cases. This is supported further by a study reported by Dorcus and Jones (1950, Abstract No. 262) in which 235 salespersons in a department store were given an interest and personality test, both of which correlated significantly with the criterion of sales.

GATB Technical Report B-555, October, 1963, based on 59 women employees in Philadelphia, Pennsylvania, resulted in a phi coefficient of .45 between Verbal Aptitude, Numerical Aptitude, Motor Coordination, and the criterion of supervisory ratings. These norms are not included in the 1962 OAP structure because they did not meet minimum statistical requirements.

Thorndike and Hagen (1959) describe 70 sales clerks tested in 1943 and followed up in 1955 and 1956 as having low general intelligence and limited educational background, especially in sciences and technology.

The Minnesota Vocational Interest Inventory (Clark & Campbell, 1965) has a scale for male Retail Sales Clerks.

Sales Person — Old DOT code: 1-75.71
New DOT code: 289.458

Thorndike and Hagen (1959) in their description of a wide variety of sales occupations make a summary statement that these persons had their highest scores on the numerical tests and were lowest on tests of mechanical abilities. There was a tendency for the men to be high on verbal and interpersonal items of the biographical section of the battery, and low on those items dealing with manual or mechanical skills and activities.

Ghiselli (1955) states that, compared to training criteria, tests of intellectual abilities and perception of details in general have substantial and equally good validity coefficients. Tests of spatial relations and mechanical principles have moderate predictive power, and the validity of motor abilities tests tends to be low. Personal data blanks have exceptionally good validity. Compared to job proficiency criteria, intellectual tests and most of the tests of perception of details give fair prediction. Spatial relations and motor tests have low validity. All measures of personality traits have at least moderately high validity.

The important subtests on the FACT (1959) battery for this occupation are Vocabulary, Arithmetic, Expression, and Memory. The required median for these subtests is low, being only the

35th percentile.

A group of 27 saleswomen who had taken the Differential Aptitude Tests in the spring of 1947 demonstrated inferior scores in practically all areas. There were special weaknesses in verbal skills--Verbal Reasoning, Spelling, and Sentences. The study, reported in the DAT manual (1959) further stated that these women had little to offer in special skills. This would indicate that when the field of selling appeals to a girl with special abilities, she should pick her entry job well so as to utilize her skills and to foresee some progress. This same study found that a sample of 23 salesmen had average scores on the DAT. Their own best scores were on Mechanical Reasoning, and Verbal Reasoning, with their poorest scores being on Clerical Speed and Accuracy.

GATB Technical Report B-553, October, 1963, based on a sample of 96 employees, resulted in a phi coefficient of .37 between General Learning Ability, Numerical Aptitude, Clerical Perception, and the criterion of supervisory ratings.

Dunnette (1960) described the distinction between industrial and retail salesmen and came to the following findings. Industrial salesmen were more ingenious. They engaged in more inventive, scientific, or problem solving activities. Retail salesmen were characterized as hard workers, very orderly, and inclined to persuade others to their point of view. Retail salesmen also showed a rejection of thinking jobs, and had a narrow interest in selling and independent business. Success in industrial sales was predicted by a test of verbal reasoning ability compared to prediction of success in retail sales by the measured level of motivation toward selling and toward gaining a dominant position in interpersonal relationships.

Dorcus and Jones (1950, Abstract No. 234) report a study in which the Bernreuter Personality Inventory was given to 75 salespersons and the scores compared to ratings by personnel managers and department heads. The characteristics which held up in the analysss were: the successful salesperson is not moody, does not worry, is self-confident, self-sufficient, aggressive, assumes responsibility, is social, free from self-consciousness, is not resentful of criticism or discipline, is radical and unconventional and has little tendency to talk about self.

Miner (1963), using the Tompkins-Horn Picture Arrangement Test, found correlations in the high .50's between successful sales performance and characteristics such as dependence, sociophilia, self-confidence, and happiness. Relationships between poor performance and low aggression, sociophobia, and strong superego were also found. It is left to the reader to consult

the original article to attempt to find definitions for the above characteristics. The author found a correlation of .30 between the Arithmetic Reasoning subtest of the Wechsler Adult Intelligence Scale and success in sales.

Secretary — Old DOT code: 1-33.10
New DOT code: 201.368

Roe (1956) reports studies which suggest that in general secretaries have no special desires or abilities, are unambitious, colorless, and moderately intelligent.

Ghiselli (1955) suggests that intelligence is useful in prediction of success in training in this occupation.

The FACT (1959) subtests which are useful in suggesting to a student that she has the abilities to enter this occupation are: Tables, Vocabulary, Expression, and Memory. A median of 45 percentile is suggested for these tests.

A follow-up study in 1951 of 140 women who were working as secretaries or stenographers, and who were given the Differential Aptitude Tests (1959) in 1947, showed that they had slightly above average test profiles, with Spelling being especially high.

Silverman (1964), using the Hackman-Gaither Interest Inventory, was able to differentiate students in the commercial curriculum. The women's Strong Blank (Strong, 1951) has keys for Office Worker and Stenographer-Secretary.

Stenographer — Old DOT code: 1-37.12
New DOT code: 202.388

The Differential Aptitude Tests manual (1959) reports a seven-year follow-up study which indicated that, with a group of 126 stenographers, their range of percentile scores was 52 to 67. Spelling and Clerical Speed and Accuracy were the highest tests with percentiles of 67 and 61, respectively.

GATB Technical Report S-10, July, 1952, based on a combined sample of 190 high school students, showed a tetrachoric correlation of .35 between General Learning Ability, Form Perception, Clerical Perception, Motor Coordination, and the criterion. The criterion for the groups was performance on the Employment Service Typing Test No. 2 and Dictation Exercise No. 10.

Several entries in Dorcus and Jones (1950, Abstracts No. 421 and 148) indicate that tests of stenographic ability are very useful in predicting success on the job as a stenographer.

Ghiselli (1955) indicates intelligence, immediate memory, arithmetic, number comparison, name comparison, cancellation, and perceptual speed are useful predictors of success in training. Immediate memory, name comparison, and number comparison are useful in predicting job proficiency.

Silverman (1964) was able to differentiate students in the commercial curriculum, using the Hackman-Gaither Interest Inventory. The women's Strong Blank (Strong, 1951) has keys for Office Worker and for Stenographer-Secretary.

Upholsterer Old DOT code: 4-35.720
New DOT code: 780.381

GATB Technical Report B-298, August, 1954, based on a validation sample of 49 employees, resulted in a tetrachoric correlation of .68 between Spatial Aptitude, Motor Coordination, Finger Dexterity, Manual Dexterity, and the criterion of supervisory ratings. A cross-validation sample of 41 employees showed a coefficient of .69 between the test norms given above and supervisory ratings. The combined sample yielded a tetrachoric correlation of .67

Welder Old DOT code: 4-88.343
New DOT code: 616.380

Ghiselli (1955) reports intelligence, mechanical principles, and arithmetic as correlating with success in training as a welder. Spatial relations and arithmetic correlate with actual job proficiency

Dorcus and Jones (1950, Abstract No. 346) report a study in which the Thurstone Identical Forms test correlated .64 between the performance of 67 electric arc welders and the criterion of supervisor's ratings after 1 to 1½ years on the job.

GATB Technical Report B-534, May, 1963, based on a sample of 54 employees, yielded a phi coefficient of .84 between Spatial Aptitude, Finger Dexterity, Manual Dexterity, and the criterion of supervisory ratings. However, the norms did not meet minimum statistical requirements for inclusion in the 1962 OAP structure.

Samuelson (1956) found GATB subtests of Clerical Perception, Finger Dexterity, and Spatial Aptitude related to success in training as a welder, but the sample was too small to allow the correlations to reach significance.

GENERAL OVERVIEW AND CONCLUDING REMARKS

A perusal of the studies in the previous section suggests that a wide variety of tests has potential validity for selection and placement in vocational school programs. A frequency count indicates that the following types of tests, in order of frequency, might logically be incorporated into a vocational school battery:

Intelligence	Manual dexterity
Spatial relations	Finger dexterity
Arithmetic	Interest
Clerical perception	Verbal (incl. expression)
Mechanical principles	Form perception
Perceptual speed	

Thus, aptitude and interest tests (two of the three broad categories of tests stated on pages 2-8 of this report) have shown value in a wide array of studies. Personality tests, while showing some promise, should still be used cautiously and on an experimental basis.

The latter statement is further supported by a recent survey of literature reported by Guion and Gottier (1965). These authors summarized articles appearing in The Journal of Applied Psychology and Personnel Psychology which appeared in 12 volumes 1952-1963. This article was examined too late to include all results in this report that we would have wished. The omission will not, however, alter our main conclusions. Guion and Gottier included not only personality tests (including projective devices), but interest tests and personal data blanks. Significant group differences and significant correlations, mostly of the order of .30 to .35, were reported for distributive occupations, clerical occupations, electronics technicians, draftsmen, and service station dealers. The authors state that:

> . . . it must be concluded that, taken as a whole, there is no generalizable evidence that personality measures can be recommended as good or practical tools for employee selection. The number of significance tests resulting in acceptable statements of validity is greater than might be expected by pure chance--but not much. The best that can be said is that in some situations, for some purposes, some personality measures can offer helpful predictions. But there is nothing in this summary to indicate in advance which measure should be used in which situation or for which purpose. (Guion & Gottier, 1965, pp. 159-160) [Italics theirs]

It seems, therefore, that personality tests might be incorporated for experimental purposes into a battery which was composed mainly of aptitude and interest tests (as defined in this report). It does not seem likely that personality tests, by themselves, would yield useful predictions to the extent that is true for aptitude tests.

Three summary statements from four different authors seem appropriate to pinpoint further the types of tests which might be incorporated in a vocational school battery. Ghiselli, whom we have cited so frequently in this report, computed the grand average validity coefficient for each test from all the data available on all jobs. These data are reported in a table, with separate average validity coefficients for each type of test and for both training and proficiency criteria (Ghiselli, 1955, p. 138). For proficiency criteria, the highest correlation is for personal data (.41), followed by interest (.27), perceptual speed (.27), and mechanical principles (.26). The correlations are higher for training criteria--for example: personal data (.44), arithmetic (.41), perceptual speed (.39), hand dexterity (.38), intelligence (.38), mechanical principles (.34), and spatial relations (.31).

Patterson (1956), after an extensive survey of the literature, concluded that a battery of tests for predicting success in trade or vocational school courses probably would contain a verbal intelligence test, a test of mechanical information or experience, a test of spatial ability, and possibly an interest test.

Super and Crites (1962), in their excellent book Appraising Vocational Fitness, seem to indicate the following tests as potentially useful predictors:

Intelligence	Mechanical principles
Clerical perception	Spatial visualization
Various achievement tests	Interest
Gross and fine manual dexterity	Personality

Based on the results of all studies cited earlier in this report, the State Occupational Research Unit staff concluded that the following list of test types might serve as a guide to the construction of a test battery for Idaho:

Intelligence	Interest
Clerical perception	Personal data
Perceptual speed	Mechanical principles
Arithmetic	Manual dexterity
Spatial relations	Finger dexterity

The above are not in any special order. All should be represented in an experimental battery. Possibly a few other test types could be included to advantage. It is interesting to note that the current state testing program in Idaho high schools, which is composed of the Differential Aptitude Tests and the Iowa Tests of Educational Development, includes many of the above measures. Furthermore, several of the area vocational schools in Idaho require the incoming student to take the General Aptitude Test Battery administered by the Department of Employment, State of Idaho. These data, if available for all or a large percentage of vocational school students, should serve fairly well as a battery for selection and placement. Measures of interest and a personal data sheet might be added to extend the range of measurement, and a few other types of tests might be added for experimental purposes.

A logical question at this point is: "Why not install such a battery of tests and start making decisions immediately based on the results?" This is usually what happens, in view of the time and effort it takes to complete validation studies for specific local situations. But the importance of local validation studies cannot be ignored. Guion and Gottier make the following statement concerning personality tests (which includes, in addition, interest tests and personal data blanks):

> It seems clear that the only acceptable reason for using personality measures as instruments of decision is found only after doing considerable research with the measure in the specific situation and for the specific purpose for which it is to be used. Sometimes, unvalidated personality measures are used as instruments of decision because of "clinical insight" or of gullibility or superstition or of evidence accumulated in some other setting. All of these may be equally condemned unless specific situational data can be gathered that the insight, superstition, or borrowed validity is in fact predictive. (Guion & Gottier, 1965, p. 160)

Ghiselli states the case for validation studies of aptitude tests:

> Let me give but three examples from validity studies where in each study the coefficient is based on at least 100 cases. For the 71 reports I was able to find for intelligence tests applied to general clerks (the validation being against proficiency criteria), the range in validity coefficients was from about -.40 to +.80. The middle 50 per cent of the coefficients covered a range of .50 correlation points. For 99 reports of spatial relations tests (validity against proficiency criteria) for machine tenders, the validity coefficients ranged from -.55 to +.65, with the middle 50 per cent of the coefficients covering a range of

> .35 correlation points. For 105 reports about mechanics, the validity coefficients for a mechanical aptitude test (validated against success in training) ranged from -.25 to +.65, with the middle 50 per cent of the coefficients covering a range of .28 correlation points. (Ghiselli, 1959, p. 398)

As a final resort, some persons may think that an extensive survey of the professional literature--or a test with extensive validation--may provide enough evidence of test validity to justify the use of a test in a new situation. This may be justified to some extent, especially if the program is administered by a professionally trained person. On the other hand, even the professional literature, as indicated by Dudek, may not be a reliable source of test validation data:

> What remains unanswered, though, is the degree to which published reports are representative of the population of studies. What percentage of all studies actually gets into print? Moreover, one can only guess whether published validities are indicative of the real distribution of validities, i.e., of "bad" as well as "good" results. It has been suggested that published coefficients run higher than unpublished ones. If so, to what extent can published findings be considered indicative of "true" validities? The odds are we will never know. (Dudek, 1963, p. 273)

We in the State Occupational Research Unit have found that studies of test validation, if they provide no data other than the relationships between test scores and a criterion, are not accepted for publication by all psychological journals. Thus, even significant results which might be of use to practitioners in the field may not get into print.

The staff of the State Occupational Research Unit plans to promote the development of local validity data for predicting success in Idaho schools. The task is a big one, requiring much time and effort. We hope that Idaho schools and other agencies and organizations within the state will cooperate with us and assist us as much as possible to complete this next major phase of our study.

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